

# STEAM METERING AND TELEMETERING



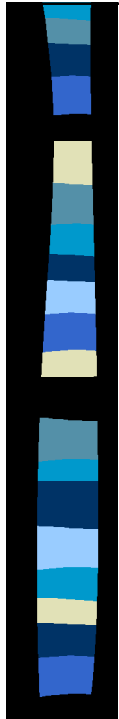
Stefan Battermann

Environmental Protection Agency  
Tour of Trigen - Philadelphia

## INTRODUCTION

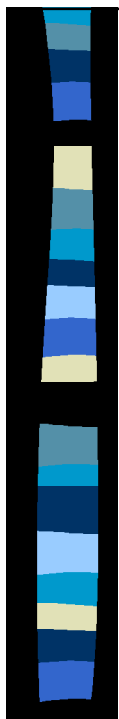
- In the past, steam was one of the most difficult substances to meter
- Old meters (pre-1990's) were maintenance intensive and inaccurate
- Today's steam meters make use of modern technology to increase reliability and accuracy





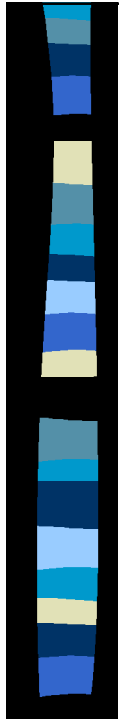
## AGENDA

- Define basic metering terms
- Examine old steam metering systems
- Discuss Trigen's reasons for replacing old systems
- Examine Trigen's new metering system
- Identify newer metering options
- Discuss telemetering options
- Demonstrate telemetering system



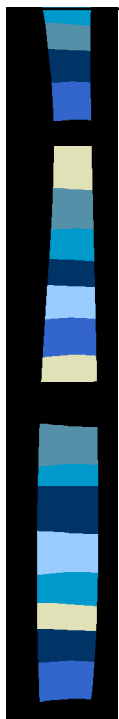
## METERING TERMS

- Accuracy
  - Stated in terms of range of meter or actual reading
  - 1.5% is good for a steam meter
- Turndown
  - Range of meter divided by lowest possible reading
  - 4:1 to 100:1 possible for steam meters



## METERING TERMS (Cont.)

- Pressure Compensation
  - Converts volumetric flow to mass flow
- Temperature Compensation
  - Converts volumetric flow to mass flow or
  - Compensates for superheated steam
- Straight Run
  - Straight pipe required before and after a meter



## METERS INHERITED BY TRIGEN IN 1987

- Condensate meters
- Turbine meters
- “Bailey” mechanical differential pressure meters

## CONDENSATE METER



## CONDENSATE IN SERVICE



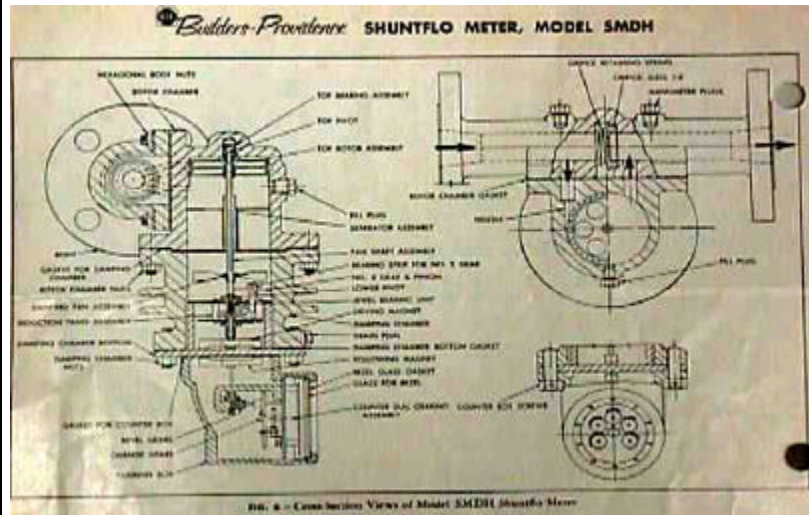
## CONDENSATE PROS & CONS

- Measures volume of condensed steam
- Very accurate and very high turndown
- No compensation necessary
- High maintenance
- Theft or line losses a problem
- Few manufacturers left
- Doesn't measure steam flow

## TURBINE IN SERVICE



## TURBINE DIAGRAM



## TURBINE PROS & CONS

- Steam spins turbine which turns dials
- 2% accuracy
- 10:1 turndown
- Very high maintenance
- Slows down over time
- Too many moving parts
- Difficult to pressure compensate
- \$4,000 is heavy price for moving parts and no pressure compensation

## BAILEY METER

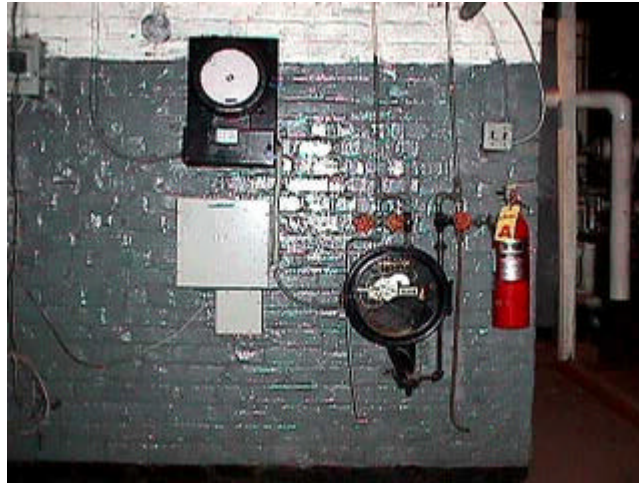


## ORIFICE PLATE





## BAILEY IN SERVICE



## BAILEY PROS & CONS

- Orifice pressure difference = flow
- 2% accurate
- 4:1 turndown
- High maintenance
- Environmental hazard
- Too many moving parts
- Difficult to pressure compensate
- No longer for sale (fortunately)





## WHY REPLACE THESE METERS?

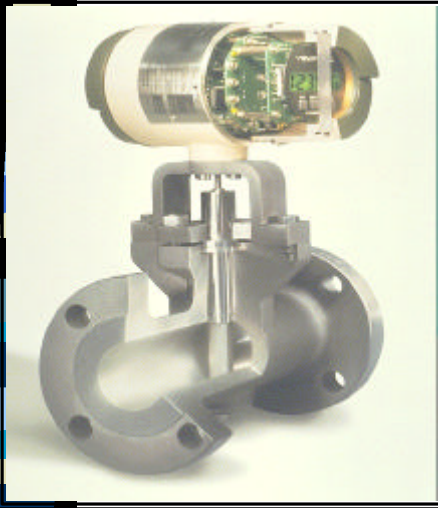
- Low turndown = loss of sales
- Moving parts = meter and customer problems
- Mechanical meters = manual reading
- Age = opportunity to modernize



## FIRST APPROACH

- Replace Bailey's with DP transmitters and flow computer
- Expensive installation (\$10,000)
- Too many items to calibrate
- 15:1 turndown OK but not great

## THE VORTEX METER

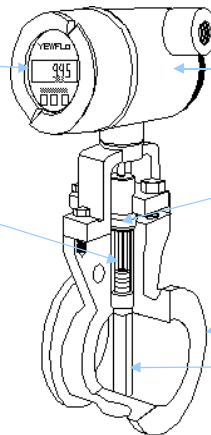


- Non-wetted piezoelectric sensor, hermetically sealed
- Solid metal shedder bar
- No ports to plug
- No thin diaphragms to damage
- Proven reliability validates 250 year MTBF

## BODY CONSTRUCTION

Indicator/Totalizer  
Local Interface

Hermetically Sealed  
Sensor

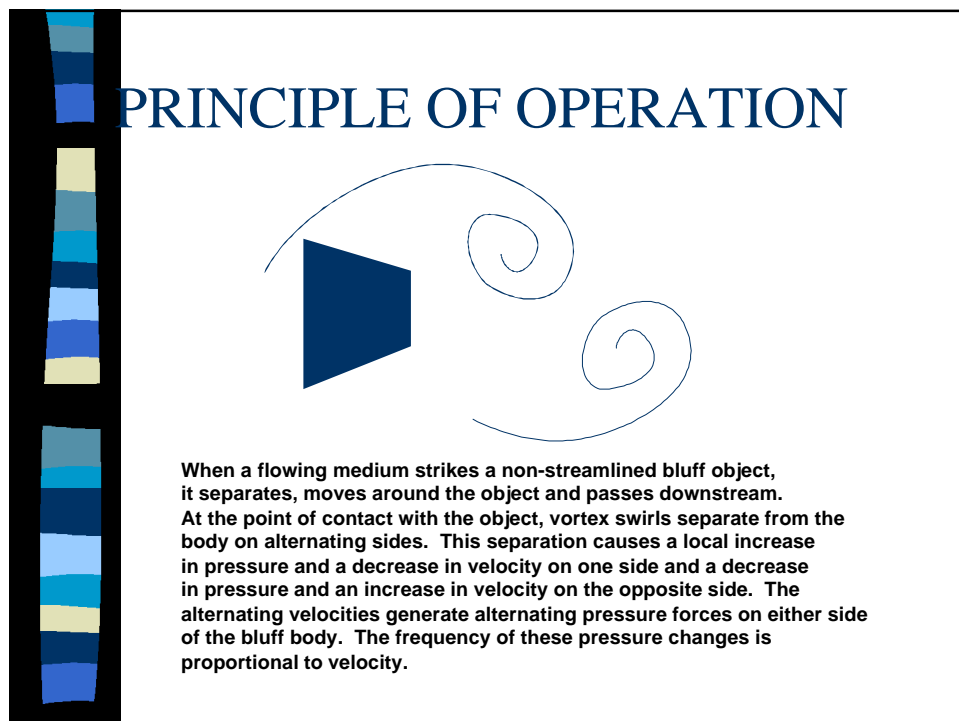
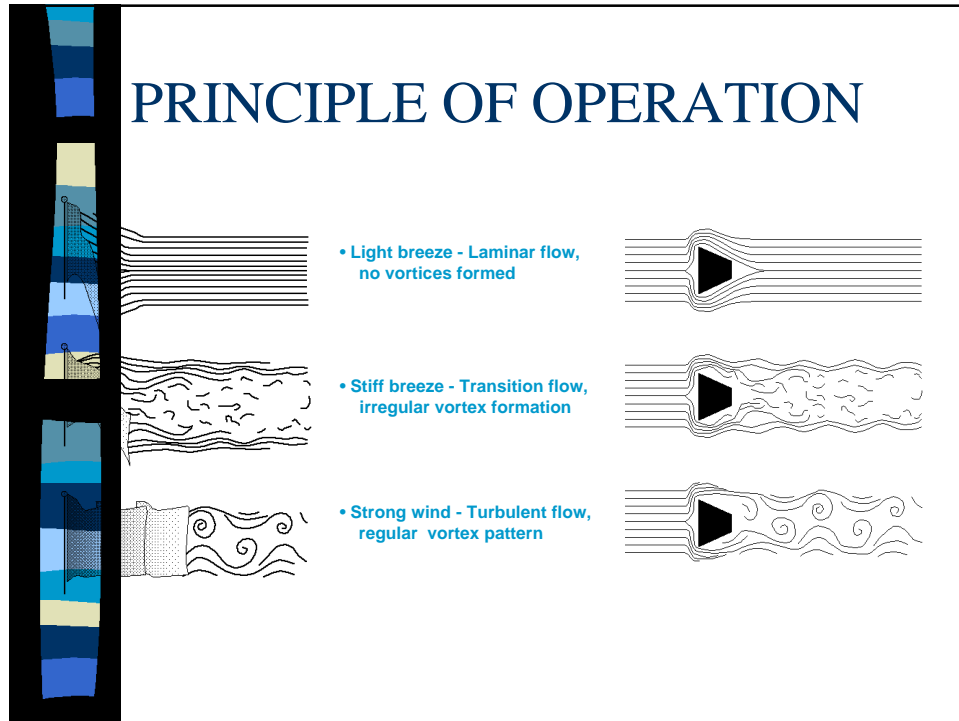


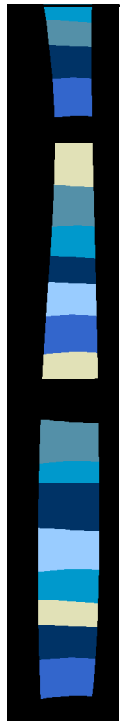
Amplifier  
• Remote available

Gasket  
• High Reliability

Body  
• Full ANSI rating

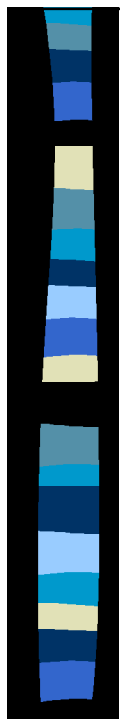
Shedder Bar  
• Solid metal  
• Rugged construction  
• No moving parts





## VORTEX ADVANTAGES

- Digital flow signal
  - No zero drift
  - Pulse output for totalizing
- 30:1 turndown
- Inherently linear output
- Low pressure drop
- Liquid, steam, or gas applications
- Immune to density & viscosity changes
- \$7,500 for full system (\$2,000 -> \$4,000) for just the meter



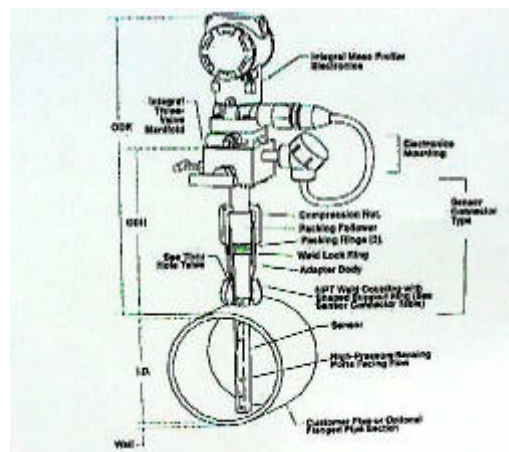
## OTHER NEW SYSTEMS

- Coriolis
  - Low maintenance condensate measurement
  - Very accurate
  - Very expensive (\$10,000 for meter only)
- Multi-variable differential pressure
  - Differential pressure, pressure, temperature and flow computer in one unit
  - Moderate price (\$3,000 - \$4,000 for meter only, but installation is simple)

## CORIOLIS PHOTO



## MASS PRO-BAR PHOTO



## OTHER NEW SYSTEMS

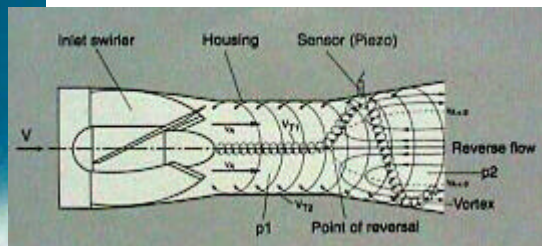
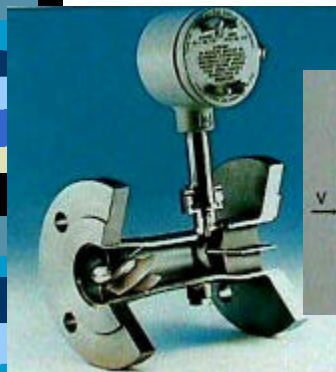
### ■ Swirl

- Low flow vortex
- Temperature compensated
- \$3,500 for meter only, full install would be about \$7,000

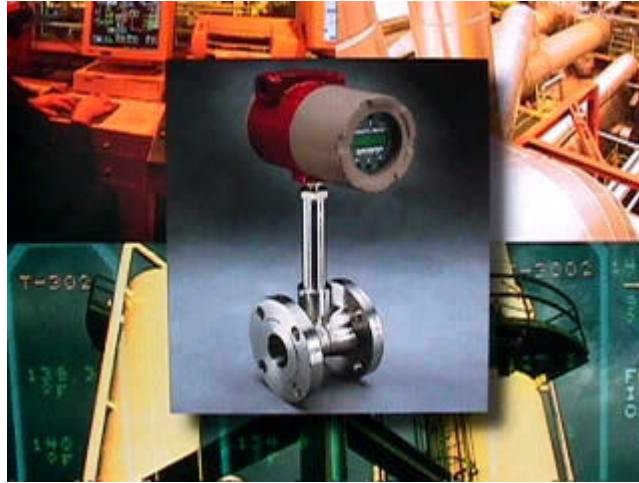
### ■ Multi-variable vortex

- Vortex, pressure, temperature and flow computer in one unit
- \$3,500 for meter only, full install would be about \$4,000

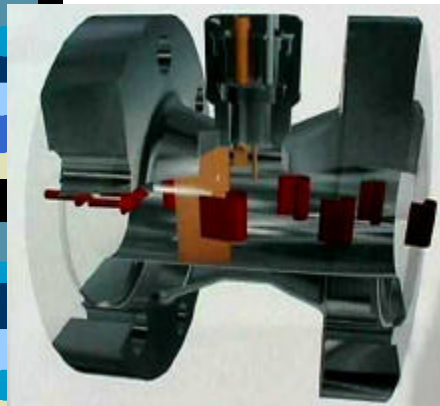
## SWIRL PHOTOS



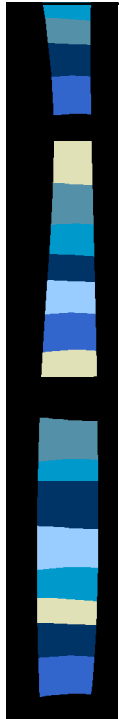
## INNOVA-MASS PHOTO



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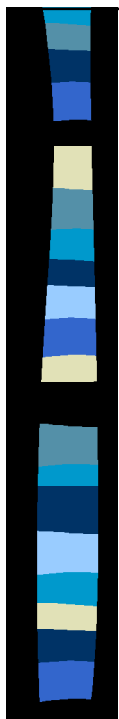






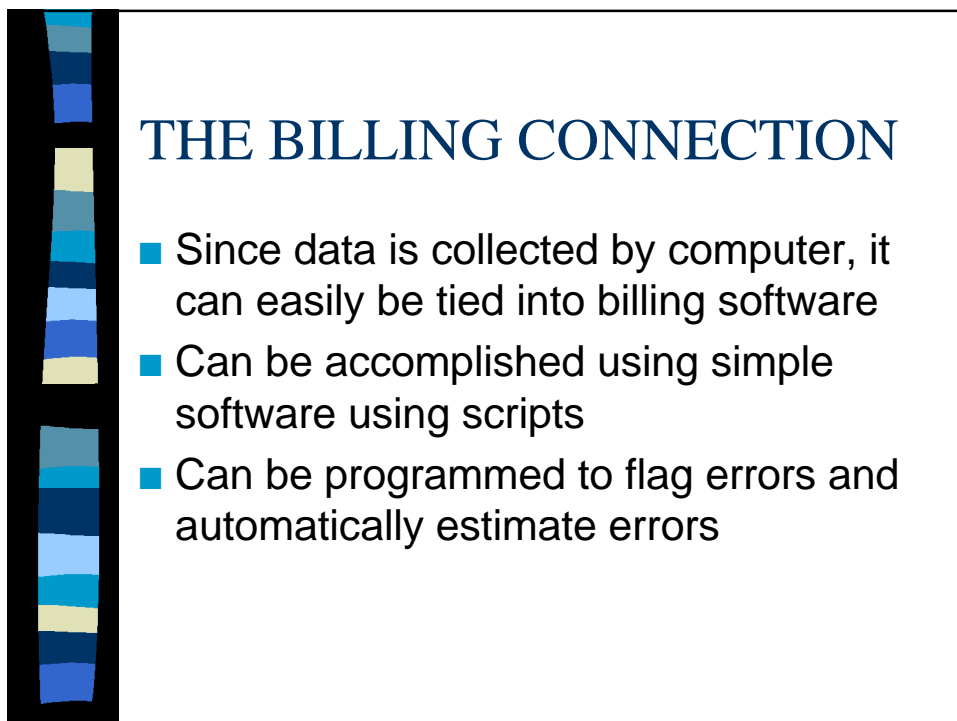
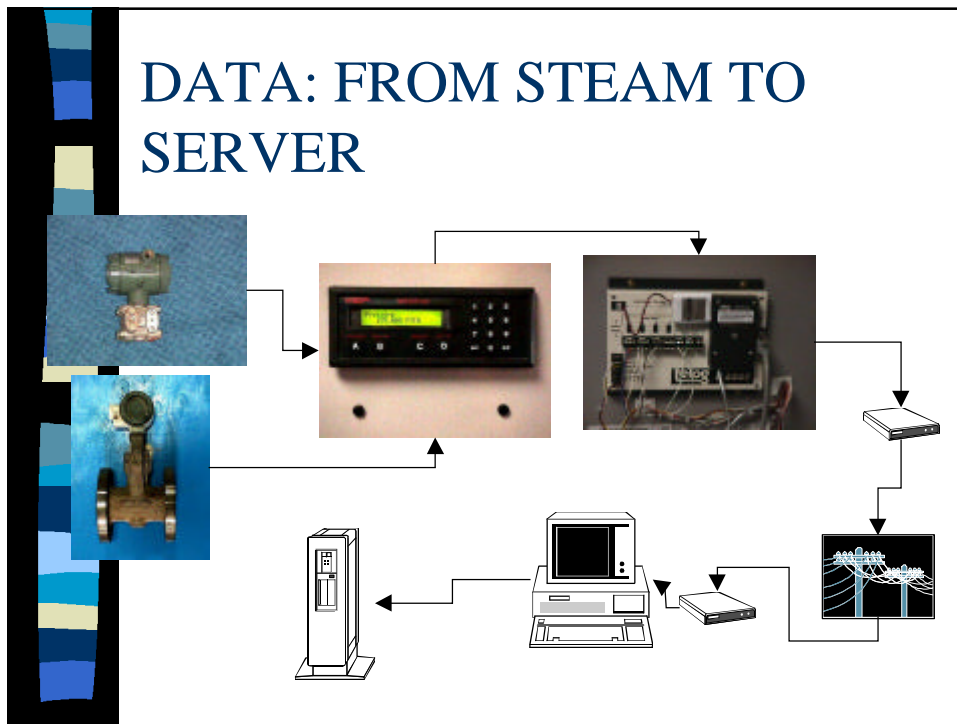
## TELEMETERING BENEFITS

- 24 hour coverage minus the labor costs
- Spot expensive methods of operation
- Spot trends and events which otherwise would go unnoticed
- Determine system efficiencies
- Eliminates paper work



## DATA TRANSMISSION

- Hardwire
  - Direct hardwire
  - Leased lines
  - Dial-up “land line” telephone
- Wireless
  - Circuit switch cellular
  - CDPD
  - Radio Modem
  - RF Two Way Data Services





## AN EXAMPLE

- CPCU uses a completely automated system
  - Meters are called totalizers are retrieved
  - Data is fed via network to billing computers
  - Computers check data and flag if unreasonable
  - Bills are wired to customer's bank
  - Bank wires money to CPCU



## ACKNOWLEDGMENTS

- Many of the images used in this presentation were provided by the following companies:
  - Sierra Instruments
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